1. *On Certain Positive-Negative Laws in their Relation to Organic Chemistry.* A. Michael.

2. *The Jurassic Formation on the Atlantic Coast.* O. C. Marsh.

3. *The Hydrolysis of Acid Amides.* Ira Remsen.

4. *The Isomeric Chlorides of Paranitroorthosulphobenzoic Acid.* Ira Remsen.

5. *The Equations of the Forces Acting in the Flotation of Disks and Rings of Metal, with Experiments showing the Floating of Loaded Disks and Rings of Metal on Water and on other Liquids.* Alfred M. Mayer.

6. *On the Geographical Distribution of Batrachia and Reptilia in the Medicolumbian Region.* E. D. Cope.

7. *On the Physical Causes of the Periodic Variations of Latitude.* S. Newcomb.

8. *On the Solar Motion as a Gauge of Stellar Distances.* S. Newcomb.

9. *Memoir of F. B. Meek.* C. A. White.

10. *The Evolution and Phylogeny of Gastropod Mollusca.* A. E. Verrill.

11. *On Flicker Photometers.* O. N. Rood.

12. *A New Type of Telescope Free from Secondary Color.* C. S. Hastings.

13. *A Graphical Method of Logic.* C. S. Peirce.

14. *Mathematical Infinity.* C. S. Peirce.

Prof. Willard Gibbs was requested to prepare a biographical notice of the late Prof. H. A. Newton, of Yale University, and Prof. S. P. Langley, a notice of the late Dr. G. Brown Goode. In addition to the serious loss the Academy has suffered in the deaths of Newton and Goode, three of the twenty-two foreign associates have died very recently, Hugo Gyldén, August Kekulé and F. F. Tisserand.

On the evening of Wednesday, November 18th, Mrs. Henry Draper gave a reception to the Academy and invited guests. In the laboratory at her house an exhibit was arranged as follows:

1. (*a*) Photograph of Delegates to the Kelvin Jubilee, June, 1896; (*b*) Radiographs, Normal and Pathological, taken by A. W. Goodspeed, Assistant Professor of Physics, University of Pennsylvania. G. F. Barker.

2. Plates of Vital Statistics of the 28 Great Cities of the United States. J. S. Billings.

3. Stereoscopic Telescope and Binocular Dissecting Microscope. H. P. Bowditch.

4. Optical Glass. Relief Plates in Color. C. F. Chandler.

5. Photographs of the new Flying Machine. S. P. Langley.

6. Views of the Lias Formation in the United States. O. C. Marsh.

7. Small Model of Interferometer. A. A. Michelson.

8. Photographs illustrating Recent Progress in the Henry Draper Memorial. E. C. Pickering.

9. Photographs showing the Effect of Pressure on the Spectrum. H. A. Rowland.

10. (*a*) Photographs and Transparencies; (*b*) Recent Geological Maps. C. D. Walcott.

RECENT ADVANCES IN MALACOLOGY.

During the past year some notable work has been published, including not only contributions to the natural history of groups, anatomy, material for monographs, etc., but also a certain number of studies which lead to a change in the point of view of whole series of evolutionary processes. As these things are too late for the latest text-books, and liable to be overlooked by teachers who are not specialists, a brief reference to some of the more important may be useful. A remarkable series of investigations by F. Bernard, on the development of hinge teeth in Lamellibranchs,* is among the most striking in the results which flow from the facts observed on the nepionic stages in many genera.

After the prodissoconch stage, when the primitive pellicle secreted by the embryonic shell gland is continuous between the valves and the ligament is simply its uncalcified median part, come the nepionic stages of which Bernard has recognized two types among the species examined. One, which is the most common, has the shell oval with an arched dorsal hingeline and convex umbones; the other has a straight hingeline, a more elongated shell and the umbones not projecting. To these might have been added the fresh water *glochidium* and *lasidium*, had species of *Naiades* or *Mutelæ* been among the forms studied. In

* Bull. Soc. Géol. de France, 3me Sér. XXIII., pp. 104–154, and XXIV., pp. 54–82, 412–449, 1896.

both the observed types there is practically no cardinal plate, the hingeline being thin, the ligament between (not outside of) its opposed edges and usually directed obliquely downward and backward. Toward the extremities of the cardinal border are found the feeble projections which indicate the beginnings, called by Bernard the *primitive lamellæ* of the permanent teeth, of which the anterior appear first. In the left valve one, and in the right valve two, of these appear, from which are developed ultimately the anterior lateral and the cardinal teeth. The posterior lamellæ give rise to the posterior laterals only.

The position of the ligament above described, and which seems to be general at this stage, is regarded by Bernard and at first sight would seem antagonistic to the dynamic hypothesis of Neumayer and others, which postulate an originally external ligament. A little reflection, however, shows that there is no real antagonism, for there is practically no mechanical distinction between inside and outside at this stage, and in the later stages it makes no essential difference, so far as the dynamics of the hinge are concerned, whether the movement which leads to a separation between ligament and resilium is upward and outward for the former, or downward and inward for the latter, the mechanics of the process being the same in either case. The ligament increases by additions from below, or at the posterior end. If these are in excess in the latter case the ligament tends to become elongated and external, in the former case short and internal; while its edges of insertion, through the deposit of shell adjacent to them, in a ligament otherwise external are almost always situated in a channel of which the nymphæ are the thickened ventral border. The dynamic reaction of the form and mode of growth of the ligament upon the form of the valves is clearly set forth by Bernard, who thus supplies an interesting contribution to the data of dynamical evolution.

The most important and unexpected result of Bernard's studies is the discovery that, in the nepionic stage of all the *Prionodesmacea*, the first development of the hinge consists in the appearance, on each side of the ligament (except in *Ostrea*, where they are solely posterior), of a series of vertical crenulations, or taxodont denticles, which are entirely distinct from the permanent teeth of the adult shell. These had been observed in a few cases previously, but their widespread occurrence, not only in the order mentioned, but also in some species of the *Teleodesmacea*, had not been suspected; while the discontinuity between them and the permanent teeth, even in such typically taxodont groups as *Nucula* and *Pectunculus*, is very remarkable. For this primitive hinge, as distinguished from the subsequently developed permanent cardinal mechanism, we may adopt the term *provinculum*. The character of the provinculum is that of two subsymmetrical areas of nearly vertical parallel ridges separated by subequal grooves, forming a taxodont apparatus similar to the permanent dental series of *Arca* and much resembling the hinge in some of the Paleoconcha illustrated by Neumayr. It is difficult to avoid the conclusion that we have in the provinculum a representative of the primitive hinge of the Protopelecypod, which was, perhaps, a free-swimming pelagic animal like *Planktomya*. The theory of Neumayr, which derives the dentition from the influence of external sculpture on the hinge margin, accentuated by natural selection, remains unshaken, but we have still to account for the gap which, in the forms yet examined, appears to intervene between the provinculum and the permanent teeth. It is probable that further researches will lead to the discovery of this missing link.

The second important fact brought out

by Bernard is that the so-called 'cardinal' teeth in the *Teleodesmacea* are genetically identical with the distal laminæ called in the adult shell 'lateral' teeth. The anterior primitive lamellæ grow, and, as they grow, curve and develop angular hooks at their proximal extremity. These hooks become detached from the main body of the lamella from which they originate and the distal part of which become 'lateral,' while the hook develops into a 'cardinal' tooth. In such a form as *Rangia* the hook remains permanently attached to the lower anterior lateral by cessation of development. The disunited portions of the hook may remain separate or, as in *Mactra*, unite with one another and so form /\-shaped teeth.

In general, the results of Bernard's work appear to confirm the unity of the groups of *Prionodesmacea* and *Teleodesmacea*, as formed by the writer, and to approximate to the latter the group of *Anomalodesmacea*, as already intimated by me. He has also in some details efficiently reinforced the dynamical doctrine as explanatory of many features in the growth and resulting form of the shell. The invalidity of Neumayr's *Desmodonta*, already fairly proven by Bittner and the writer, is confirmed, while the moribund order, *Septibranchia*, finds no support in the development of the hinge.

It has long been known that the gill of *Planorbis* is a flat lobe, not lamellose like most external molluscan breathing organs, and recently Pelseneer* has reviewed and added to our knowledge of this organ and analogous structures in several gastropod types. This gill plate is not homologous with the typical prosobranch ctenidium, but is an independent development accessory to the lung of the fresh water pulmonates. It occurs in one form or another in most of them, even *Limnæa* showing a rudiment in some cases. In our *Ameria scalaris* Jay, from Florida, the plate is large and smooth, as in *Planorbis*. In one of the Physiform planorboids from the southern hemisphere, which at one time were generally confounded with the true *Physidæ* in default of a knowledge of their anatomy, Pelseneer describes a further step in the evolution of this organ. In the *Ameria lamellata* Smith, of Madagascar, the plate is transversely folded into lamellæ, as in the great majority of molluscan gills, thus giving another example of the ease with which similar but non-homologous breathing organs are developed among mollusks, a feature which I have long insisted on. No cases of this kind have been known among Pelecypods hitherto, but recently Bernard* in an interesting paper on a new commensal bivalve mollusk, *Scioberetia australis*, has described a case where the reticulated true ctenidium is formed by the folding and subsequent perforation of a single plate, instead of the growth and subsequent concrescence of single filaments. The latter process has been supposed to be almost, if not quite, universal in the *Teleodesmacea* and Anisomyarian *Prionodesmacea*. Bernard suggests that the mode of development in some of these may really be similar to that of *Scioberetia*, and shows that the whole subject requires further study.

More recently still, Simroth,† in a valuable memoir on the Pelecypoda of the pelagic region, has described a new type, *Planktomya Henseni*, a minute and seemingly strictly pelagic bivalve, in which the true ctenidium has the simple lamellar form of the gill of *Planorbis*, without transverse plications or free filaments. So the evidence grows of how structurally similar breathing organs, whether strictly homologous or not, may be developed either as a orm of the true ctenidia, or elsewhere, in

* Arch. de Biologie, XIV., pp. 357–393, 1895.

* Bull. Scientifique de la France, XXVII., pp. 362–395, 1896.

† Die Acephalen der Plankton Expedition, Leipzig, 1896.

response to the needs of the organism. Even if *Planktomya* should eventually prove to be an immature Leptonoid, the fact of the mode of development of the ctenidium would remain of the greatest interest. The existence of this minute form, apparently confined to the open sea between the latitudes of Ascension Island and Bermuda, suggests that the earliest (Cambrian) bivalves may also have been pelagic, which would explain their rarity and minuteness. Of the various larval bivalves found in the Plankton, all are dimyarian and destitute of a pallial sinus, the oral palpi develop in advance of the gills, which appear either as a single lamella on each side or as a number of buds not exceeding ten, while the hinge is either edentulous or taxodont; in all these characters recalling the Paleoconcha.

WM. H. DALL.

SMITHSONIAN INSTITUTION.

A STUDY OF THE COLON BACILLUS GROUP, AND ESPECIALLY OF ITS VARIABILITY IN FERMENTING POWER UNDER DIFFERENT CONDITIONS.

A RESEARCH on the colon bacillus group of bacteria has been in progress during the past two years in the Laboratory of Hygiene of the University of Pennsylvania, in accordance with a scheme prepared by Dr. Weir Mitchell and Dr. John S. Billings, the director of the laboratory, for an investigation on the variability of bacteria, under the auspices of the Bache fund. A resumé of the results of last year's work was published in this JOURNAL under the title 'The Influence of Certain Agents in Destroying the Vitality of the Typhoid and the Colon Bacillus,' and the following article records the experiments made since that time. The organisms which, owing to certain common characteristics, are usually included in the group under examination, the colon bacillus group, have excited much interest during the past few years because of their resemblance to the bacillus of typhoid fever and the difficulty attending the differentiation of certain varieties of the colon bacillus from this organism; and also because of the importance ascribed in recent years to the bacillus coli communis, the type of this group, as a cause of inflammation and abscess in man. This organism first isolated by Escherich, in 1886, has been found to be constantly present in the intestinal canal of man, and also in that of many of the lower animals. Different observers have noticed variations in the characteristics of cultures obtained from different sources, and some have been disposed to consider each of these varieties to be a separate species, but the similarity of many prominent features of these cultures finally led to a grouping of these organisms as varieties of a species. Different groups of colon bacilli have been described by several writers. Achard[1] and Renault in 1892 had observed five types of the colon bacillus, and Tavel[2] had isolated fifteen varieties. Stoeklin[3] distinguishes thirteen forms which he classifies by their motility and the number of flagella. Gilbert[4] finds five varieties. Fremlin[5] describes several varieties obtained from different animals. Refik[6] records five varieties found in water. But an article published by Dr. Th. Smith[7], entitled 'Notes on the Bacillus Coli Communis and its Related Forms,' in which several varieties of the colon bacillus and other similar organisms are tabulated, showing their differentiation by means of the fermentation test and also by the comparison of other distinguishing reactions, has been the means of making better known a number of the different varieties and of establishing a basis for further classification. Very little comparison can be made, however, between the varieties described by Smith and those by other writers because of the paucity of the tests recorded by the latter.

Cultures from the species designated by